CLAIMS

1. A method for manufacturing a micro-electro-mechanical device, which has supporting parts and operative parts, comprising:

providing a first semiconductor wafer, having a first layer of semiconductor material, and a second layer of semiconductor material, arranged on said first layer;

forming first supporting parts and first operative parts of said device in said second layer;

bonding said first wafer to a second wafer, with said second layer facing said second wafer; and

forming, after the bonding step, second supporting parts and second operative parts of said device in said first layer.

2. The method according to claim 1 wherein said step of forming second supporting parts and second operative parts comprises:

thinning said first layer; and

anisotropically etching a residual portion of said first layer.

3. The method according to claim 1 wherein said first operative parts are electrostatically coupled to respective said second operative parts.

4. The method according to claim 1 wherein said first and second supporting parts comprise fixed supporting parts and moving supporting parts.

5. The method according to claim 1, comprising the step of forming elastic elements connecting said supporting parts and said operative parts.

6. The method according to claim 5 wherein said step of forming elastic elements comprises forming said elastic elements in said first layer.

7. The method according to claim 6 wherein said elastic elements comprise first torsional elastic elements, aligned to a first axis, and second torsional elastic elements, aligned to a second axis.

8. The method according to claim 1 wherein said step of providing said first wafer comprises forming interconnection lines arranged between said first layer and said second layer.

9. The method according to claim 8 wherein said step of forming interconnection lines comprises:

forming a conductive layer on said first layer; and

shaping said conductive layer.

10. The method according to claim 8, comprising the step of making, in said second layer, through interconnections connected to said interconnection lines.

11. The method according to claim 1, comprising, prior to said step of forming second supporting parts and second operative parts:

depositing a metal layer on a face of said first layer opposite said second layer; and

shaping said metal layer.

12. The method according to claim 1, comprising:

forming sacrificial anchoring structures connecting said first and second supporting structures and said first and second operative structures, to prevent corresponding movements;

cutting said wafer into a plurality of dice, each die comprising a respective micro-electro-mechanical device; and

removing said sacrificial anchoring structures.

13. A micro-electro-mechanical device comprising:

a first layer of semiconductor material and a second layer of semiconductor material fixed to a base;

first supporting parts and first operative parts formed in said second layer;

second supporting parts and second operative parts formed in said first layer; and

interconnection lines at least partially arranged between said first layer and said second layer, and through interconnections extending through said first layer and electrically connected to said interconnection lines.

14. A method for manufacturing a micro-electro-mechanical device, comprising:

defining, in a first semiconductor substrate, a plurality of anchor regions;

bonding a second semiconductor substrate to the first substrate;

forming, after the bonding and defining steps, a rotor region in the first semiconductor substrate such that the anchor regions remain between the rotor region and an outer region of the first substrate; and

removing the anchor regions such that the rotor region is free to move with respect to the outer region and the second substrate.

15. The method of claim 14, comprising:

forming a layer of semiconductor material on the first semiconductor substrate; and

forming electrostatic stator elements in the layer of semiconductor material;

and wherein the bonding the second semiconductor substrate to the first substrate step comprises bonding the second semiconductor substrate to the layer of semiconductor material, and the forming the rotor region in the first semiconductor

substrate step comprises forming electrostatic rotor elements in the first semiconductor substrate.

16. The method of claim 14, comprising:

cutting, prior to the removing the anchor regions step, the first and second semiconductor substrates into a plurality of individual dice.

17. A method, comprising:

applying a voltage potential to an electrostatic stator element formed in a first layer of semiconductor material; and

applying a second voltage potential to an electrostatic rotor element formed in a second layer of semiconductor material, the second layer having a region thereof mechanically coupled to a region of the first layer of semiconductor material, and the electrostatic stator and electrostatic rotor elements having respective comb-fingers staggered with respect to each other.

18. A micro-electro-mechanical device, comprising:

a first layer of semiconductor material lying in a first plane;

a first plurality of stator elements formed in the first layer and having a comb-finger configuration;

a second layer of semiconductor material coupled to the first layer and lying in a second plane, parallel to the first plane; and

a first plurality of rotor elements formed in the second layer and having a comb-finger configuration, the first plurality of rotor elements staggered with respect to the first plurality of stator elements.

19. The device of claim 18, further comprising:

a first rotor body formed in the second layer and configured to rotate in a first axis, the first axis lying in the second plane; and

a second rotor body formed in the first rotor body and configured to rotate in a second axis.

20. The device of claim 19 wherein the first plurality of rotor elements is mechanically coupled to the first rotor body and electrostatically coupled to the first plurality of stator elements, the device further comprising:

first and second torsional elements lying in the first axis and anchoring the first rotor body to a peripheral region of the second layer of semiconductor material;

third and fourth torsional elements lying in the second axis and anchoring the second rotor body to the first rotor body;

a second plurality of stator elements formed in the first layer and having a comb-finger configuration;

a second plurality of rotor elements formed in the second layer coupled to the second rotor body and having a comb-finger configuration, the second plurality of rotor elements staggered with respect to the second plurality of stator elements.

21. The device of claim 18, further comprising:

a semiconductor material body coupled to the first layer of semiconductor material.

22. The device of claim 18, further comprising:

a mirror formed on the second layer.